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Hymenochaete in China. 2. A new species and three new records from Yunnan Province

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Abstract — A new species and three new Chinese records of *Hymenochaete* are reported: *H. yunnanensis* sp. nov., *H. fulva*, *H. spathulata,* and *H. sphaerospora*. They were all collected from Caiyanghe Nature Reserve, Yunnan Province, southwestern China. *Hymenochaete yunnanensis* (in sect. *Hymenochaete*) is characterized by setal hyphae and heavily encrusted hyphae and hymenial cells. Complete descriptions with illustrations are provided for the four species.

Key words — *Hymenochaetaceae*, taxonomy, wood-inhabiting fungi

Introduction

Because of the abundant woody plants and the complex topography, the diversity of wood-inhabiting fungi is extremely high in Yunnan Province and adjacent areas of southwestern China. During the last decade, the porioid wood-inhabiting fungi in these areas have been intensively investigated and many papers were published (Cui et al. 2011; Dai & Zhou 2000, Dai et al. 2007, Dai 2010, 2011a; Niemelä et al. 2001; Yu et al. 2008; Yuan & Dai 2008a,b). However, the corticioid wood-inhabiting fungi in these areas have not been sufficiently studied. The corticioid genus, *Hymenochaete* Lév., is one of the most important genera in the *Hymenochaetaceae*. Although it has been studied by several mycologists (Dai 2010, 2011b; Maekawa & Zang 1995; Xu et al. 2003; Zhang & Dai 2005), the genus has not yet been systematically studied in southwestern China.

Caiyanghe Natural Reserve, located in southern Yunnan Province, is one of the famous nature reserves in China because it is a transitional area from the tropical to the subtropical zone with the altitude ranging from 980–1707 m. The main vegetation type is a monsoon evergreen broadleaf forest, comprising

mainly species of *Castanopsis*, *Lithocarpus* and *Schima* (Jing & Chen 2007). In the summer of 2011, an intensive survey of wood-inhabiting fungi in Caiyanghe and Xishuangbannan Natural Reserve, southern Yunnan Province, was carried out and more than 130 *Hymenochaete* specimens were collected. Among these specimens, *Hymenochaete yunnanensis* is identified as a new species. In addition, *H. fulva*, *H. spathulata* and *H. sphaerospora* are found in China for the first time. Illustrated descriptions of these species are provided in this paper.

Materials & methods

Voucher specimens are deposited in the herbarium of Beijing Forestry University (BJFC), and the microscopic procedure follows He (2010). In the text the following abbreviations are used: L = mean spore length (arithmetical average of all spores), W = mean spore width (arithmetical average of all spores), Q = variation in the L/W ratios between the specimens studied (quotient of the mean spore length and the mean spore width of each specimen), n = the number of spores measured from given number of specimens. In presenting the size range of spores, 5% of the measurements were excluded from each end of the range, and the measurements were given in parentheses. IKI stands for Melzer's reagent, KOH for 5% potassium hydroxide, and CB is the abbreviation of Cotton Blue. IKI– = inamyloid and nondextrinoid, CB– = acyanophilous. Special color terms follow Petersen (1996).

Taxonomy

Hymenochaete yunnanensis S.H. He & Hai J. Li, **sp. nov.** Figs. 1–2

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Carpophorum effusum vel effuso-reflexum, laxe adnatum. Cortex, tomentum et stratum hypharum adsunt. Hymeniis et hyphae cum resinaceus granulum encrustatae. Setosum hyphae adsunt. Setae 40–75(–80) × 6–7(–9) µms, porae ellipsoideae, 5–6.5(–6.8) × (2.8–)3–3.5(–3.8) µm.

Type: China. Yunnan Prov., Pu'er, Caiyanghe Nat. Res., alt ca. 1200 m, on fallen angiosperm branch, 9 VI 2011 He 709 (**holotype**, BJFC).

Etymology: *yunnanensis*, refers to its type locality of Yunnan Province, China.

Fruitbody: Annual, effused or effused-reflexed with slightly elevated margins, loosely adnate, easily detached, coriaceous, brittle when dry, first as small colonies, later confluent, resupinate part up to 8 cm long or more in longest dimension, reflexed part projecting up to 0.3 cm, 180–300 µm thick in section. Pileal surface rust-brown to dark brown, silky, tomentose, curving down when dry. Hymenophore smooth or with scattered tubercles, grayish brown to clay-buff, usually covered with many yellowish resinous matters, not cracked or with few deep crevices when dry; resupinate margin thinning out, distinct, silky, fimbriate, yellowish to yellowish brown when juvenile, becoming indistinct or slightly elevated, concolorous with hymenium when mature.

Fig. 1. Basidiocarps of *Hymenochaete yunnanensis* (He 709, holotype).

Hyphal structure: Hyphal system subdimitic; generative hyphae without clamp connections; tissue darkening but otherwise unchanged in KOH.

Subiculum: Cortex, tomentum and hyphal layer present. Cortex composed of strongly agglutinated hyphae, 20–50 μm thick. Generative hyphae hyaline to yellowish brown, thin- to thick-walled, septate, moderately branched, sometimes collapsed, more or less interwoven and agglutinated, usually heavily encrusted with resinous matters, 2–4 μm in diam. Skeletoids with distinctly thickened walls, reddish brown, rarely septate and branched. Setal hyphae (embedded setae) frequently present, up to 200 μm long.

Stratified hymenium: Hyphae in this layer similar to those in subiculum, hyaline, thick-walled, agglutinated, uprightly arranged, 2.5–4.5 μm in diam. Setal layer thickening, composed of several rows of overlapping setae. Setae numerous, subulate or fusiform, reddish brown, with an acute tip, projecting up to 45 μm above the hymenium, 40–75(–80) × 6–7(–9) μm. Hymenial cells usually heavily encrusted with resinous matters. Cystidia and hyphidia absent. Basidia clavate, with four sterigmata and a simple septum at base, 12–20 × 3.8–5 μm; basidioles in shape similar to basidia, but slightly smaller.

Basidiospores ellipsoid, some with tapering apex, hyaline, thin-walled, smooth, IKI–, CB–, 5–6.5(–6.8) × (2.8–)3–3.5(–3.8) μm, L = 5.79 μm, W = 3.16 μm, Q= 1.79–1.87 (n = 60/2).

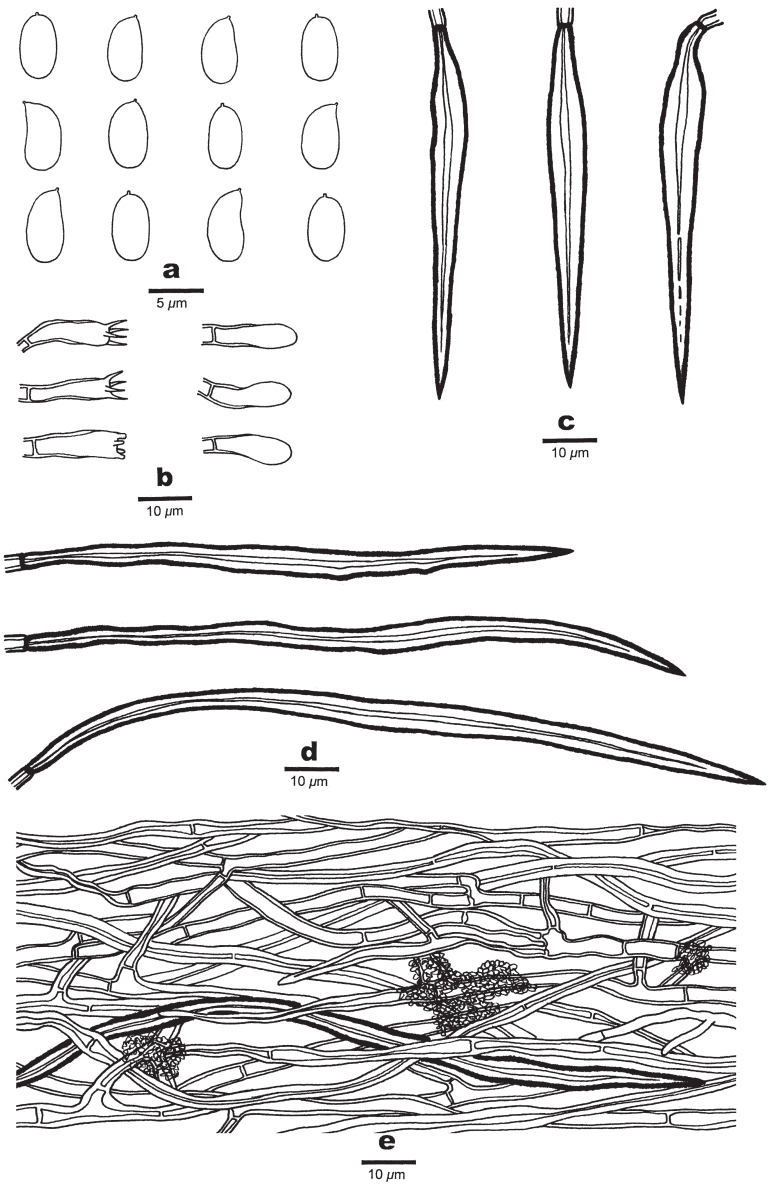

Fig. 2. Microscopic structures of *Hymenochaete yunnanensis* (drawn from the holotype). a: Basidiospores. b: Basidia and basidioles. c: Setae. d: Setal hyphae. E: Hyphae from subiculum.

Additional specimens examined: **CHINA. Yunnan Prov.**, Pu'er, Caiyanghe Nat. Res., alt ca. 1200 m, on fallen angiosperm twig, 9 VI 2011 He 690 (BJFC).

Remarks: *Hymenochaete yunnanensis* belongs to sect. *Hymenochaete* (presence of cortex, hyphal layer and setal layer; Léger 1998) and is characterized by the presence of setal hyphae and the heavily encrusted hyphae and hymenial cells. Usually the hymenial cells are so heavily encrusted that the resinous compounds form numerous yellowish dots on the hymenophore surface.

Microscopically, the new species is very close to *H. ulmicola* Corfixen & Parmasto; however, *H. ulmicola* differs in growing in the bark fissures of old living *Ulmus* trees and in having thicker, harder and smaller basidiocarps and slightly larger basidiospores (5.5–7.5 × 3–4 μm; Corfixen & Parmasto 2005). Another similar species, *H. colliculosa* (Sacc.) Parmasto, can be distinguished from the new species by its larger setae (80–110 × 7.5–11 μm) and basidiospores (5.5–7.5 × 3.6–4.8 μm; Parmasto 2005). *Hymenochaete fulva* also has encrusted hyphae, but differs from *H. yunnanensis* in the yellowish brown basidiocarps, broadly ellipsoid basidiospores (5–6 × 3.2–4 μm), and absence of setal hyphae (Parmasto 2001).

Hymenochaete fulva Burt, Ann. Mo. Bot. Gard. 5: 354, 1918 Figs. 3–4

Fruitbody: Annual, effused, closely adnate, coriaceous, first as small colonies, later confluent up to 8 cm or more in longest dimension, 150–300 μm thick. Hymenophore smooth, cinnamon-brown, yellowish brown or clay-

Fig. 3. A basidiocarp of *Hymenochaete fulva* (He 620).

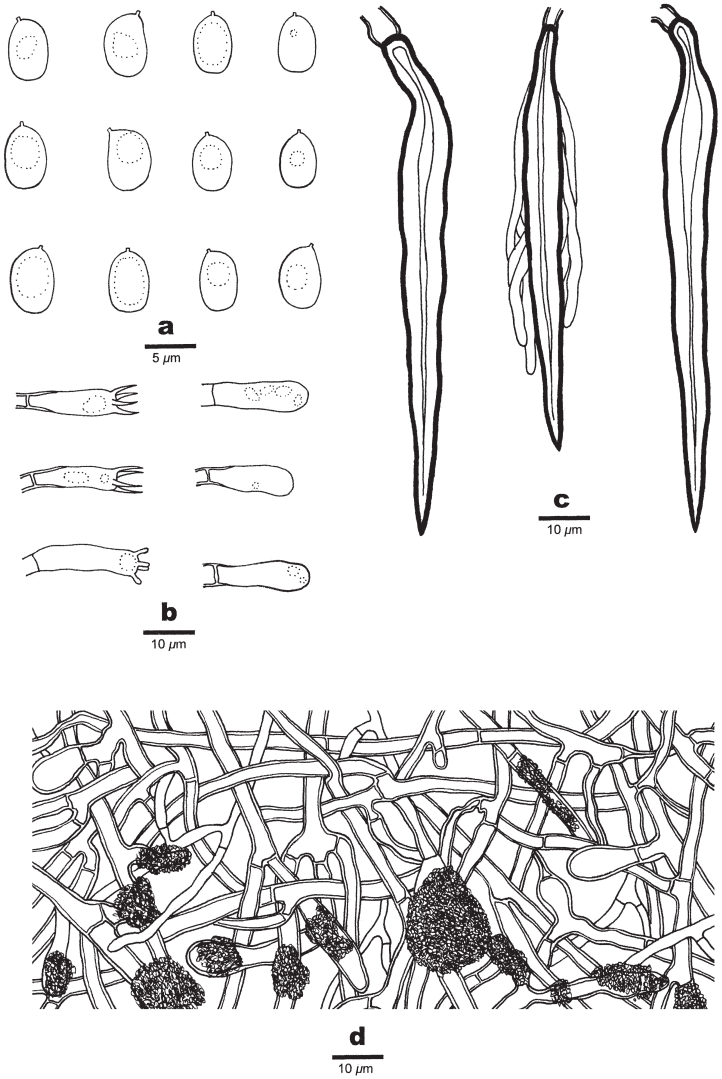

Fig. 4. Microscopic structures of *Hymenochaete fulva* (drawn from He 620). a: Basidiospores. b: Basidia and basidioles. c: Setae. d: Hyphae from subiculum.

buff, azonate, not cracked or sometimes with numerous deep crevices; margin thinning out, distinct, paler than hymenophore surface, yellowish brown.

Hyphal structure: Hyphal system monomitic; generative hyphae without clamp connections; tissue darkening but otherwise unchanged in KOH.

Subiculum: Tomentum absent; cortex and hyphal layer present. Cortex composed of strongly agglutinated hyphae, 10–20 µm thick. Generative hyphae hyaline to yellowish brown, thick-walled with a wide lumen, some lightly or heavily encrusted with yellowish brown resinous granules, frequently septate, moderately branched, loosely interwoven, 2.5–5 µm in diam.

Stratified hymenium: Hyphae in this layer similar to those in subiculum, yellowish to yellowish brown, thick-walled, more or less agglutinated, interwoven, 2–4.8 µm in diam. Crystals occasionally present in the hymenium. Setal layer composed of 1–3 rows of overlapping setae. Setae numerous, reddish brown, subulate, sometimes enmeshed with a hyphal sheath, with an acute tip, projecting up to 80 µm above the hymenium, 60–100(–110) × 7–10(–11) µm. Hyphidia absent, encrusted cystidia-like hyphal ends present. Basidia clavate, with four sterigmata and a simple septum at base, 15–22 × 4–5 µm; basidioles in shape similar to basidia, but slightly smaller.

Spores: Basidiospores broadly ellipsoid, hyaline, thin-walled, smooth, usually bearing a large guttule, IKI–, CB–, (4.8–)5–6 × 3.5–4 µm, L = 5.43 µm, W = 3.82 µm, Q = 1.40–1.44 (n = 60/2).

Specimens examined: **CHINA. Yunnan Prov.**, Pu'er, Caiyanghe Nat. Res., alt ca. 1400 m, on fallen angiosperm twig, 6 VI 2011 He 620 & 640.

Remarks: *Hymenochaete fulva* belongs to sect. *Hymenochaete* and is characterized by its yellowish brown basidiocarps, encrusted hyphae, and broadly ellipsoid basidiospores. The "cystidia" of the species cited by Burt (1918) and Léger (1998) are actually encrusted hyphal ends (Parmasto 2001). *Hymenochaete fulva* has also been reported in Mexico and Jamaica (Parmasto 2001). The species is close to *H. rhododendricola* S.H. He & Hai J. Li and *H. rhabarbarina* (Berk.) Cooke; however, both species differ from *H. fulva* in their encrusted setae and absence of cortices (He & Li 2011a; Parmasto 2001).

Hymenochaete spathulata J.C. Léger, Bull. Soc. Mycol. Fr. 96: 409, 1981 ["1980"] Figs. 5–6

Fruitbody: Annual, effused, closely adnate, coriaceous, first as small colonies, later confluent up to 20 cm or more in longest dimension, 180–280 µm thick. Hymenophore smooth, pale mouse-gray to light vinaceous gray, azonate, not cracked; margin thinning out, distinct, whitish, fimbriate when juvenile, becoming indistinct, concolorous with hymenophore surface when mature.

Hyphal structure: Hyphal system monomitic; generative hyphae without clamp connections; tissue darkening but otherwise unchanged in KOH.

Fig. 5. Basidiocarps of *Hymenochaete spathulata* (He 685).

Subiculum: Tomentum and hyphal layer absent. Cortex locally present, thin, composed of strongly agglutinated hyphae.

Stratified hymenium: Generative hyphae hyaline to yellowish brown, thin- to thick-walled with a wide lumen, densely interwoven, 1.8–3.6 µm in diam. Setal layer thickening, composed of several rows of overlapping setae. Setae scattered, reddish brown, spathulate, with an obtuse tip, usually lightly encrusted with crystals at the tip, projecting up to 50 µm above the hymenium, 65–100 × 8–13 µm. Cystidia and hyphidia absent. Basidia clavate, with four sterigmata and a simple septum at base, 12–16 × 3.5–4 µm; basidioles in shape similar to basidia, but slightly smaller.

Spores: Basidiospores cylindrical to allantoid, hyaline, thin-walled, smooth, IKI–, CB–, 6–7.1(–7.5) × 1.8–2.1 µm, L = 6.65 µm, W = 1.98 µm, Q = 3.36 (n = 30/1).

Specimens examined: **CHINA**. **Yunnan Prov.**, Pu'er, Caiyanghe Nat. Res., alt ca. 1200 m, on fallen angiosperm twig, 9 VI 2011 He 685 & 704.

Remarks: *Hymenochaete spathulata* is distinguished in the genus by its gray basidiocarps, spathulate setae, and cylindrical to allantoid basidiospores (Léger 1998). Another species with round-tipped setae is *H. ryvardenii* Parmasto, which differs from *H. spathulata* by thicker (≤ 800 µm) basidiocarps and larger ellipsoid basidiospores (6.5–8 × 3–3.6 µm; Parmasto 2000). Previously

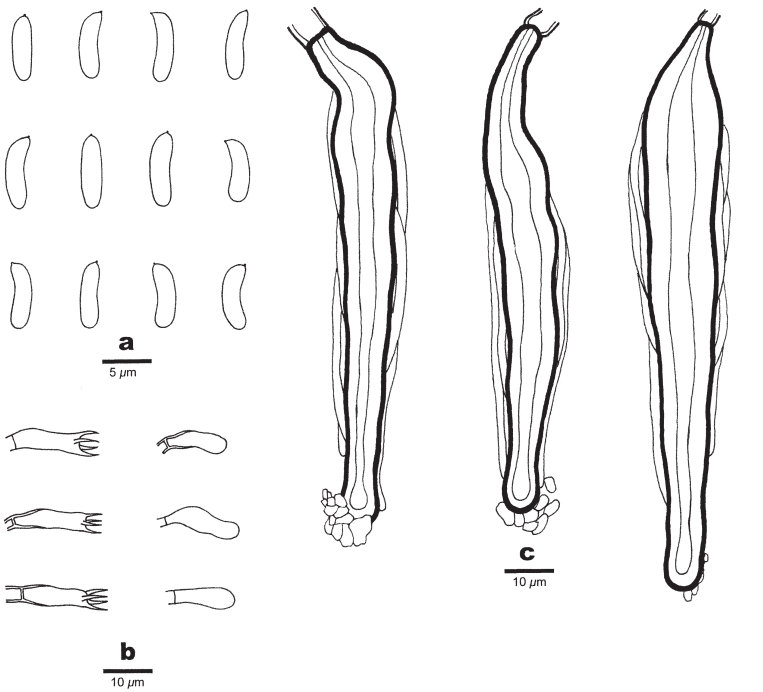

Fig. 6. Microscopic structures of *Hymenochaete spathulata* (drawn from the He 685). a: Basidiospores. b: Basidia and basidioles. c: Setae.

H. spathulata was known only from Gabon and the Central African Republic (Léger 1998).

Hymenochaete sphaerospora J.C. Léger & Lanq., Bull. Soc. Mycol. Fr. 103: 48, 1987 Figs. 7–8

Fruitbody: Perennial, effused, closely adnate, woody hard when dry, confluent up to 20 cm or more in longest dimension, 250–400 μm thick. Hymenophore smooth, pale mouse-gray to grayish brown, azonate, not cracked or finely cracked when dry; margin thinning out, distinct, fawn to cinnamon, up to 2 mm wide.

Hyphal structure: Hyphal system monomitic; generative hyphae without clamp connections; tissue darkening but otherwise unchanged in KOH.

Subiculum: Tomentum absent. Cortex and hyphal layer sometimes present.

Fig. 7. A basidiocarp of *Hymenochaete sphaerospora* (He 691).

Stratified hymenium: Generative hyphae hyaline to yellowish brown, thick-walled, agglutinated, densely interwoven, 2–3 µm in diam. Setal layer thickening, composed of several rows of overlapping setae. Setae numerous, reddish brown, subulate, encrusted with fine crystals in the upper part, with an acute tip, projecting up to 40 µm above the hymenium, 65–110 × 9–16(–19) µm. Cystidia absent. Simple hyphidia present. Basidia clavate or cylindrical, with four sterigmata and a simple septum at base, 23–34 × 4.5–6 µm; basidioles in shape similar to basidia, but distinctly smaller.

Spores: Basidiospores broadly ellipsoid or subglobose, hyaline, thin-walled, smooth, usually bearing a large guttule, IKI–, CB–, 5–6 × 4–5 µm, L = 5.52 µm, W = 4.33 µm, Q = 1.27 (n = 30/1).

Specimens examined: **CHINA. Yunnan Prov.**, Pu'er, Caiyanghe Nat. Res., alt ca. 1200 m, on fallen angiosperm twig, 9 VI 2011 He 691 & 715.

Remarks: Léger (1998) and Parmasto (2005) previously reported *H. sphaerospora* from Africa. It is diagnosed by the gray basidiocarps, large encrusted setae, and broadly ellipsoid or subglobose basidiospores. *Hymenochaete macrospora* Y.C. Dai, which has similar basidiospores, differs from *H. sphaerospora* in the brownish annual basidiocarps and smooth setae (Dai et al. 2000). The also similar *H. megaspora* S.H. He & Hai J. Li is distinguished from *H. sphaerospora* by its larger spores (7.5–10 × 5–7) and effused-reflexed basidiocarps (He & Li 2011b).

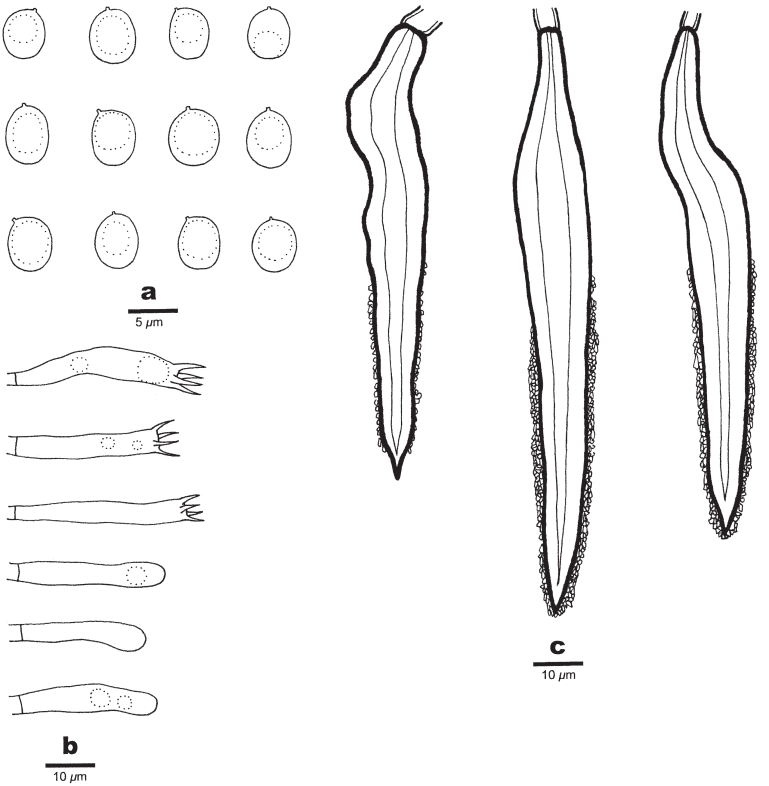

Fig. 8. Microscopic structures of *Hymenochaete sphaerospora* (drawn from He 691). a: Basidiospores. b: Basidia and basidioles. c: Setae.

To date, 19 *Hymenochaete* species (including the four reported here) have been reported from Yunnan Province (Maekawa & Zang 1995; Xu et al. 2003; Zhang & Dai 2005).

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